The Jefferson City Fire Department Staffing Study: Are We Protecting Our Citizens?

LEADING COMMUNITY RISK REDUCTION

By: Robert Lee Turner, Jr.
Jefferson City Fire Department
Jefferson City, Tennessee

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ABSTRACT

The problem is that the Jefferson City Fire Department has been unable to conduct a statistical analysis on current staffing levels in relation to our operational effectiveness and current national and local trends. The purpose of this project was to conduct this analysis to determine the Jefferson City Fire Department's operational effectiveness with current staffing levels and identify trend and guidelines for future staffing. Evaluative research method was utilized to answer the research questions. The identified research questions are:

1. What are the national standards applicable to guide fire department staffing levels similar to the Jefferson City Fire Department?
2. Compared to the Jefferson City Fire Department, what are the pertinent fire department statistics for similarly sized communities?
3. What are the current staffing levels for the Jefferson City Fire Department?
4. How does the Jefferson City Fire Department current staffing levels for operations compare with national standards and other similar sized community fire departments?

A literature review of national, local and periodicals was conducted to determine what, if any, standards and guidelines existed to assistance the Department with staffing guidelines and standards. A survey was created and distributed to twenty-two similar sized and characterized communities throughout the State of Tennessee. Performance indicators, including department size, population protected, average daily staffing,

municipal property tax rate, fiscal year budget and services provided, were established for the survey departments.

National standards concluded that the minimum number of staffing for on-scene operations at a structure fire should be no less than four firefighters and, on some occasions, such as high hazard or special occupancies, should be more. These standards were complemented by the survey of local, similar sized communities staffing with an average career staff of at least 3.5 or 4 firefighters per shift. The Jefferson City Fire Department operates well below both these national standards and local averages, as determined by the survey.

The conclusion determined was that the Jefferson City Fire Department is not adequately staffed with career firefighters on shift. This conclusion is based on accepted national standards and guidelines, the survey completed by local, similar sized communities and other related research.

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INTRODUCTION

In order for modern fire service organizations to provide expected, adequate emergency services to the communities they serve, the organizations must know what and how many resources they must provide. Currently, the City of Jefferson City, Tennessee utilizes a combination fire department strategy to provide fire and rescue services for the community. The problem is the Jefferson City Fire Department has not been able to do a statistical analysis on current staffing levels in relation to our operational effectiveness. Without this analysis or research into the actual needs, national standards and accepted practices, the Department has no justifiable means to pursue planning for and implementing staffing proposals or actual changes in day-to-day operations and/or actual staffing levels. The purpose of this Applied Research Project (ARP) is to do a statistical analysis of Jefferson City Fire Department's operational effectiveness with current staffing levels. Evaluative research method was utilized to answer the research questions. The identified research questions are:

5. What are the national standards applicable to guide fire department staffing levels similar to the Jefferson City Fire Department?
6. Compared to the Jefferson City Fire Department, what are the pertinent fire department statistics for similarly sized communities?
7. What are the current staffing levels for the Jefferson City Fire Department?
8. How does the Jefferson City Fire Department current staffing levels for operations compare with national standards and other similar sized community fire departments?

BACKGROUND AND SIGNIFIGANCE

Jefferson City, Tennessee is a small rural city, which has a permanent residence population of 7760 citizens (United States Census, 2001). The City employs seven career firefighters and maintains approximately thirty reserve, paid-on-call firefighters, which operate out of a single station. The City encompasses approximately 3.2 square miles. The City operates under a City Manager/City Council form of government. Council members are elected to four-year terms on a staggered schedule and the Mayor is elected to a two-year term. The City Manager reports to the Mayor and Council and provides the guidance for the day-to-day operation of the City. Jefferson City is primarily made up of residential zoned areas with some light industrial and manufacturing facilities. Carson-Newman College, a private religious college, lies in the heart of Jefferson City and has approximately 6,000 students enrolled each year. A majority of the structures on the Carson Newman Campus are considered historical in nature and therefore lack basic fire protection characteristics and features. Jefferson City is located in Jefferson County, Tennessee, which has been deemed the second fastest growing county in the entire State of Tennessee (Annual Report, East Tennessee Development District, 2002). Although Jefferson City is not the county seat of Jefferson County, it is the largest community in this rural county.

A Fire Chief, who is a career employee of the City, leads the fire department. A reserve Deputy Chief serves as the coordinator of the reserve forces. The remaining career employees include a Fire Inspector and five Driver-Operators, who drive and operate the first responding apparatus. The Jefferson City Fire Department was formed in

September of 1907. Currently, the Department staffs three engines, one aerial ladder and two support vehicles. The Fire Department responds to structure fires, fire alarm activations, motor vehicles collisions with and without injury, hazardous materials incidents and service calls in the community. Firefighters are also called to respond with the six other fire departments in Jefferson County to provide mutual aid and support on-scene operations. In 2004, fire department resources and personnel responded to approximately 1015 calls for service. The operating budget of the fire department was $453,000 in FY 2004 – 2005.

Fire departments, especially those who provide fire protection and rescue services to small rural communities, have always struggled to provide the most appropriate, safest level of coverage to their communities of responsibility. In the past, many municipalities have looked at their fire department operations from the perspective of getting the big, red truck to the fire and preventing the spread of the fire to other structures in the immediate area. Once the fire department arrived, firefighters simply made the best with what they had on scene. Staffing, firefighter safety, appropriate use of tools and fire streams were not as important as simply getting the fire engine to the fire. It really did not matter if the apparatus arrived with one firefighter/driver or a full compliment of trained, certified firefighters.

Fire departments, no matter their size or location must provide a certain level of basic services to its citizens. Freeman (2002) clearly lays this out as Rescue (of trapped occupants), Exposure Protection (prevention of fire spread), Confinement (of the fire), Extinguishment (of the fire), Ventilation (of smoke and products of combustion), Salvage

(conservation of property) and Overhaul (insuring the fire is out and property loss is stopped) (p. 24).

The most important reason the Jefferson City Fire Department exists is the services, especially emergency response, it provides to its citizens. Nothing presents the goals and objectives of the Department better than its Mission Statement. The Mission Statement of the Jefferson City Fire Department:

> To protect the citizens and visitors of Jefferson City from the adverse effects of fire, natural and man-made disasters and to provide effective fire prevention opportunities through public fire and life safety education.

The appropriate level of staffing would directly address and affect three of the operational objectives of the United States Fire Administration (USFA) and begin the department on the right track for accomplishing the fourth as listed below:

a. Reduce the loss of life from fire in the age group 14 years old and below.

b. Reduce the loss of life from fire in the age group 65 years old and above.

c. Reduce the loss of life from fire of firefighters.

d. To promote within communities a comprehensive, multi-hazard risk reduction plan led by the fire service organization (USFA, 2002, II-2).

In addressing the fourth, as listed above, the author feels that we must first determine the appropriate level of response to emergencies and once this service is in correct form, focus the full effort and direction of the Department on leading and implementing a strategy of risk reduction and multi-hazard prevention in the community. As discussed in the National Fire Academy's Leading Community Risk Reduction Course, the fire department must take the leading role in all hazard community risk reduction. One of the

primary purposes of this research was to determine the appropriate level of staffing for the Jefferson City Fire Department so effort can be focused on providing prevention services to the community with the appropriate level of staffing in the department.

Recent national newspaper articles have highlighted the needs of the American fire service in the areas of staffing. USA Today (2004) wrote, "While staffing companies to a nationally recognized standard is desirable, it is beyond the reach of many financially strapped communities" (p.1). Dedman (2005) states, "Once a day on average in this country, someone dies when firefighters arrive too late" (p.1) and "Even when they arrive quickly…[firefighters] commonly muster too few firefighters to put out blazes effectively and safely"(p. 2). Dedman (2005) also quotes noted fire protection expert and retired deputy fire chief Vincent Dunn saying:

> Fire protection in America is a myth. These two subjects are the dirty little secrets of the fire service: The response times outside the center cities are too great, and the personnel responding, inside and outside the center cities, are too few (p.2).

In the past, the department has struggled to determine the appropriate level of staffing for the both the career and reserve forces. This project shall focus on the career staffing problem. It is hoped that a clarification and determination will be made for staffing solutions in the future.

LITERATURE REVIEW

In order to determine the proper level of staffing for fire apparatus, fire administrators must look at other departments, accepted national standards and comply with state and federal mandates and applicable laws. An extensive review of materials

relevant to this research project was conducted. The materials consisted of periodicals, Internet articles, video sources, interview with Chief Officers, Company Officers, Firefighters and trade representatives and appropriate books and textbooks. A large amount of the research completed in the Applied Research Paper (ARP) was completed at the National Fire Academy's Learning Resource Center (LRC) in Emmitsburg, Maryland. The contribution of surveys of staffing levels, jurisdiction profile information and minimum staffing policies from twenty-two fire departments significantly contributed to this applied research project. The lack of a staffing study for the Jefferson City Fire Department makes this applied research paper significant, especially since the results will enhance safety of both Jefferson City Firefighters and the citizens we protect.

Although he was writing about the transition of an all volunteer fire department to a partially career one, Harry Carter discussed factors that might influence the changing of service delivery and/or the level of staffing for fire departments:

> Many communities have crossed the line that separates viable volunteer delivery systems from situations in which career people must be brought on board to bridge gaps in the delivery system. What criteria must you review to decide whether your department has crossed that line? Answers to the following questions should help determine where you are and what fork in the road you must consider taking.
>
> 1. Have the numbers of emergency responses increased by more that 50 percent in the last 10 years?
> 2. Has the population of your area doubled in the past decade?

3. Does your fire department respond to more nuisance calls now than a decade ago?
4. Are housing costs in your community so high that it is prohibitive for young members to buy?
5. Do you average fewer that ten members per fire response? (Fire Command, 1990, p.17-18).

While reviewing these internal departmental questions, it may also be important to introduce what another author feels brings the winds of change to departments. Chief Ron Coleman lists the following factors in determining the need to change delivery of fire suppression services:

The following catalysts for change tend to be the most influential:

1. Growth in demand for services, especially ambulance and rescue services.
2. Municipal budget constraints and/or contractual labor demands.
3. Not enough volunteers available during the day.
4. Pressure to improve the productive use of paid firefighter "downtime".
5. The complexity of modern firefighting and the length of training volunteers require to meet community fire-safety standards.
6. Economics of scale (some cities may be served by multiple fire departments) (Coleman, 1988, p.418).

Keyson (2002) asked, in an interview with Battalion Chief William Goldfeder, "Why don't people like to ask about staffing problems?" and Chief Goldfeder replies:

> Because it costs money and this is usually the reason for many of the problems we have in the fire service. When responding to a fire, you must accomplish certain tasks. To accomplish these tasks, you've got to have people to do it. … even on a single-family dwelling fire, it takes a certain number of people to accomplish the tasks (p. 90-93).

The International Association of Firefighters (IAFF) writes:

> Historically, the standard for fire suppression in North America has mandated an offensive attack in situations involving structure fires. Study after study has demonstrated that the force available to initiate an interior fire attack is less than fifteen personnel, the goals of victim rescue, fire control and property conservation are seriously compromised (IAFF, 1993, p. 2).

Question one asks, "What are the national standards applicable to guide fire department staffing levels similar to the Jefferson City Fire Department?" The problem of adequate firefighting personnel on the scene of the emergency is not a new one. The problem existed many years ago when fire fighting was more "labor intensive". "The function of pulling a hand pumper to a fire and then pumping it were labor intensive; and a lot of people were needed to fulfill them" (Clark, 1995, p. 619). Clark (1995) further states:

> …the standard of six or seven people (including the officer) survived until a trend to smaller companies began in the nineteen sixties. The reduction became quite widespread and is the most controversial fire service issue of the last fifty years (except hair length and apparatus color, neither of which have much impact on fire losses) (p. 620).

Even among the national fire chief, firefighter and fire prevention associations in the United States, there is great division as to what the appropriate level of staffing for fire departments should be. The National Fire Protection Association (NFPA), an association responsible for developing the majority of consensus standards used by fire departments in the United States, clarifies the many variables in determining appropriate fire department staffing by listing "… such things as the population protected, population density, firefighter's work hours per week, response distances and firefighter safety" (Paulsgrove, 2003, p. 7-21).

Freeman (2002) places the decision of staffing clearly at the local Jurisdiction level, writing the following:

> Different staffing schemes prevail depending on budgetary considerations, actual fire frequency, and demand for such fire department corollary services as EMS. In fact, fire company staffing levels vary from department to department. They may be influenced not only by the factors just mentioned, but also by the population protected (which may be different from the census population), population density, types of structures, and response distances; by response and workload data; or by local labor agreements. But although fire unit staffing levels vary from department to department, most departments establish minimum staffing levels (i.e., the minimum number of personnel necessary to operate each unit of firefighting equipment) on the basis of the afore mentioned factors (Freeman, 2002, p.126-127).

Many authors, fire department members, instructors and risk managers have attempted to determine the proper level of staffing for fire companies. Pegram (2001) weighs in by

offering a simple, but true method for determining appropriate staffing levels for prevention of firefighter deaths and injuries. He states, “The formula used to determine the minimum number of personnel for this response is simple: the number of tasks + the number of firefighters to complete each task = the total manpower needed (p. 27). Pegram (2001) recognizes that for fighting a simple one-story, residential fire, the responding agency will need 16-20 firefighters as outlined below:

- (1) Incident Commander to command the incident
- (1) Driver/Operator to operate apparatus
- (2) Firefighters to advance the initial attack lines
- (2) Firefighters for search and rescue of trapped occupants
- (2) Firefighters to place ground ladders and/or provide ventilation.
- (2) Firefighters for deployment and advancement of a back-up hose line.
- (1) Additional Driver/Operator to assist with water supply/hydrant operations.
- (2) Firefighters to relive first attack crew.
- (2) Firefighters to check for extension/overhaul
- (3) Firefighters for the Rapid Intervention/Firefighter Rescue Team

For a total of 18 firefighters (p. 27).

In attempting to determine staffing needs, Smith (1996) states that staffing needs will vary from city to city and even from different areas of the same town. He further suggests dividing fireground tasks into those that are completed simultaneously and those completed sequentially. “Some can be performed in sequence; others must be done simultaneously, especially in early operations (Smith, 1996, p.621). Initial fireground

resources dispatched to the scene will determine which operations are started and how those operations are either successfully completed or result in utter failure.

The National Fire Protection Association's Fire Protection Handbook recognizes the need for proper staffing of fire department operational units by " … it has been demonstrated that when staffing levels fall below four firefighters per company, fire ground effectiveness may be compromised" (Paulsgrove, 2003, p. 7-22).

Paulsgrove (2003) also recommends the following:

> In general, however, each engine company should have a minimum of four firefighters on duty, including an officer. This parallels NFPA 1500 and OSHA requirements to have at least four firefighters on scene before starting interior structural firefighting. It would seem inappropriate to dispatch an engine company to a fire if the crew could not start firefighting or rescue operations because of safety concerns (p.7-22).

NFPA 1410, 2000 Edition *Standard on Training for Initial Emergency Scene Operations* states "... the company officer shall insure that the following are accomplished in interior structural fires:

(1) At least two firefighters enter the immediately dangerous to life and health (IDLH) atmosphere and remain in visual or voice contact with each other at all times.

(2) At least two firefighters are located outside the IDLH atmosphere (NFPA 1410, Section 3-2.2).

Annex A of the standard 1410 further notes:

> With the exception of very small communities and isolated rural areas, the standard response to an emergency incident on the initial alarm is generally a minimum of two engine companies and a truck company. This practice is for several reasons. First, one engine company ordinarily cannot be expected both to operate the proper streams promptly for fast attack and to provide the necessary back-up stream(s). Experience has frequently shown that small streams often prove to be inadequate. Second, fires commonly necessitate prompt application of hose streams from at least two positions. Finally, the possibilities that an accident or mechanical failure will delay the arrival of one company is always present (Section 1-2.1).

Finally, NFPA 1410 (2000) details:

> The minimum recommended staffing level for a fire company responding to any type of fire consists of four members responding on or arriving with each engine and aerial ladder company. Companies responding in high-risk areas should have a minimum acceptable staffing of six firefighters on ladder companies and five firefighters on engine companies (Section A-3-2.5).

NFPA (2000) bases these recommendations upon "… studies indicate significant reductions in performance and safety when crews have fewer members than recommended. Overall, five-member crews were found to provide a more coordinated approach for search and rescue and fire suppression tasks (Section A-3-2.5).

In another national consensus standard, NFPA 1500, *Standard on Fire Department Occupational Safety and Health Programs*, 2002 Edition, the NFPA

addresses the level of staffing recommended to be on the incident scene prior to beginning operations in the IDLH atmosphere. NFPA (2002) identify the following:

> In the initial stages of an incident where only one crew is operating in the hazardous area at a working structure fire, a minimum of four individuals shall be required, consisting of two individuals working as a crew in the hazard area and two individuals present outside this hazard area available for assistance or rescue at emergency operations where entry into the danger area is required (Section 8.4.7).

NFPA 1500 further clarifies who can make up this crew and what functions they can serve on the incident scene. NFPA 1500 (2002) outlines this guideline by stating:

> The assignment of any personnel, including the incident commander, the safety officer, or operators of fire apparatus, shall not be permitted as stand-by personnel if by abandoning their critical task(s) to assist or, if necessary, perform rescue, they clearly jeopardize the safety and health of any firefighter working on the incident (Section 8.4.12).

Another NFPA standard addresses the issue, recommends the initial staffing of a minimum of four firefighters for initial operations, and provides suggestions on how the staffing situation may be solved (NFPA, 2002, Appendix C). NFPA 1561, *Standard on Emergency Service Incident Management Systems* (NFPA, 2002) says, “In the initial stages of an incident where only one crew is operating in the hazardous area at a working structure fire, a minimum of four individuals is required …” (appendix C). As part of Appendix C, NFPA (2002) offers the following recommendations as far as working out the staffing of the four firefighters on the scene:

(1) The team leader and one firefighter could advance a fire-fighting hoseline into the IDLH atmosphere, and one firefighter and the pump operator become the stand-by members.

(2) The team leader could designate the pump operator to be the incident commander. The team leader and one firefighter enter the IDLH atmosphere, and one firefighter and the pump operator remain outside as the stand-by members.

(3) The two firefighters could advance the hoseline in the IDLH atmosphere, and the team leader and pump operator remain on the outside as stand-by members (Appendix C).

NFPA 1710, *Standard on the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the public by career Fire Departments*, 2003 Edition states that "On-duty fire suppression personnel shall be comprised of the numbers necessary for firefighting performance relative to the expected firefighting conditions" (Section 5.2.1.1). Further, NFPA (2003) suggests that the appropriate number of on-duty personnel be determined by task analysis using the factors of life hazard the population protected, potential property losses, types of firefighting tactics used by the department, and special hazards or internal protection characteristics of the properties involved (Section 5.2.1). NFPA (2003) also provides for the division on labor at the incident by dividing fireground work into that performed by engine companies and that performed by ladder or truck companies (section 5.2.1.1). Engine companies, or those companies responsible for pumping and delivering water, performing basic firefighting operations at fires and search and rescue on the scene of

fires, shall "be staffed with a minimum of four on-duty personnel" (NFPA, 2003, Section 5.2.2.1.2). In areas with tactical hazards, high hazard occupancies, high incident frequencies, and geographic restrictions, NFPA (2003) states, " … these companies shall be staffed with a minimum of five or six on-duty members"(Section 5.2.2.1.2). Ladder companies, or those companies primarily assigned to perform forcible entry, ventilation, search and rescue, aerial operation, utility control, illumination, overhaul and salvage work, shall "… be staffed with a minimum of four on-duty personnel (NFPA, 2003, Section 5.2.2.2.1). And, once again, NFPA (2003) states that ladder companies operating in areas with tactical hazards, high hazard occupancies, high incident frequencies, and geographic restrictions "shall be staffed with a minimum of five or six on-duty personnel" (Section 5.2.2.2.2).

NFPA 1710 also details the initial alarm assignment capacity, or what a department should be sending to a structure fire within a designated time to extinguish the fire and rescue victims. NFPA (2003) identifies that "the fire department shall have the capacity to deploy an initial full alarm assignment within an eight minute response time to ninety percent of the incidents" (Section 5.2.3.2.1). NFPA 1710 calls for the following personnel and assignments on the scene of a structure fire:

(1) Establishment of incident command outside of the hazard area for the overall coordination and direction of the initial full alarm assignment. A minimum of one individual shall be dedicated to this task.

(2) Establishment of an uninterrupted water supply of a minimum of 400 gallons per minute (GPM) for thirty minutes. Supply lines shall be maintained by an operator who shall ensure uninterrupted water flow application.

(3) Establishment of an effective water flow application rate of 300 GPM from two handlines, each of which shall have a minimum of 100 GPM. Attack and back-up lines shall be operated by a minimum of two personnel each to effectively and safely maintain the lines.

(4) Provision of one support person for each attack and back-up line deployed to provide hydrant hookup and to assist in line lays, utility control and forcible entry.

(5) A minimum of one victim search and rescue team shall be a part of the initial full alarm assignment. Each search and rescue team shall consist of a minimum two personnel.

(6) A minimum of one ventilation team shall be a part of the initial full alarm assignment. Each ventilation team shall consist of a minimum of two personnel.

(7) If an aerial device is used in operations, one person shall function as an aerial operator who shall maintain primary control of the aerial device at all times.

(8) Establishment of an Initial Rapid Intervention Crew (IRIC) that shall consist of a minimum of two properly equipped and trained personnel (Section 5.2.3.2.2).

The NFPA has also developed a similar standard for volunteer fire departments entitled NFPA 1720: *Standard on the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the public by Volunteer Fire Departments*, 2003 Edition. While NFPA 1710 pertains to fully career

firefighters, JCFD is a career/volunteer or combination fire department. NFPA 1720 must also be considered. In chapter 4 of NFPA 1720:

> "4.3.2* Table 4.3.2 shall be used by the Authority Having Jurisdiction (AHJ) to determine staffing and response time capabilities, and the fractal accomplishment of that for reporting purposes as required in chapter 4.
>
> Table 4.3.2 Staffing and Response Time

Deemed Zone	Demographics	Staffing and Response Time	Percentage
Special Risks	AHJ	AHJ	90
Urban	1000 people/1 sq. mile	15/9	90
Suburban	500–1000 people/1 sq. mile	10/10	80
Rural	Less than 500 people/ sq. mile	6/14	80
Remote*	Less than or equal to travel distance of 8 miles	4	90

> *Upon assembling the necessary resources at the emergency scene, the fire department should have the capacity to safely initiate an initial attack with 2 minutes 90 percent of the time." (NFPA 1720, 2004, p.16)

Table 1

By using this standard table, Jefferson City falls under the urban demand zone, and need 15 personnel on the scene within nine minutes, ninety percent of the time. Although situated in a suburban area of East Tennessee, the population density in Jefferson City matches that of a larger city. This is undoubtedly the result of the private four-year college located in the heart of the City. However, this is only part of the problem. The City experiences a large population shift in the daytime hours as workers gather at their places of employee in the City's industrial park, school age and adult learner attend places of both elementary and higher education and numerous commuters navigate the City's major highway between the cities of Knoxville and Morristown, Tennessee.

Amazingly, the federal government has very little to say or few guidelines for fire departments to follow in regard to staffing. "The Occupational Safety and Health Administration (OSHA) creates and enforces regulations to protect the safety the American workforce. Current OSHA regulations that apply to firefighters include 29 CFR 1910.134, Respiratory Protection" (Jakubowski & Morton, 2001, p. 37). Jakubowski & Morton (2001) further state, " … if firefighter must enter an IDLH atmosphere, at least two must enter together…" and "In addition, at least two properly equipped and trained firefighters must be positioned outside the IDLH atmosphere, must account for the interior teams and must remain capable of rapid rescue of the interior teams" (p. 37). Since the State of Tennessee is a non-OSHA state, the Tennessee Occupational Safety and Health Administration (TOSHA), a division of the Department of Labor and Workforce Development is responsible for insuring compliance with federal OSHA standards, which have been adopted by the State as minimum standards. In adopting 24 CFR 1910.134, *Respiratory Protection Standard*, Tennessee requires two properly trained and equipped firefighters to be positioned outside the IDLH atmosphere (OSHA1910.134, Section G, paragraph 4, 1998).

Although not necessarily considered national standard, fire departments, public administrators and business/homeowners have long used the Insurance Service Office's Grading Schedule for Fire Departments as an evaluation tool for the fire department to determine their abilities at controlling structure fires and an evaluation of how the department is completing its mission. The ISO provides a classification to a City based upon a I to 10 scale, with 10 being essential no fire protection to a 1 representing the best ranking a department can receive. The ISO assesses the City's water system capacity for

fighting fire, the equipment, training and staffing of the fire department and the fire department's ability to dispatch and receive alarms and calls for service. The Jefferson City Fire Department was last evaluated by the ISO in January 1992. The City received an insurance classification of five as a result of the evaluation. In the Classification Details Report of the evaluation, the Department received a grade of 2.67 points out of the possible 15+ category of "Credit for Company Personnel" (ISO, 1992, p. 3). Further, ISO provides suggestions for improving classifications in the Improvement Statements section of the report. ISO stated,

> An increase in the on-duty personnel by one person will increase the fire department credit by .63 and an increase in the response by other fire department members by one person will increase the fire department credit by .21 (ISO, 1992, p. 6).

Hickey (2002) suggests that no other section of the fire department grading section is as important as staffing. Over fifteen percent of the actual fire department grade can be achieved through proper staffing of fire department resources. He notes that fire chiefs and city administrators have more influence over the staffing grade than any other issue (p. 139).

In summary to question one, it appears that there are numerous national standards and guideline for staffing fire departments and the apparatus they respond with, however it is strictly a local decision to implement which, if any, of the standards. The research found that the average staffing for first due fire apparatus should be at least four, with more in specialized or high hazard areas.

Question two asks, "Compared to the Jefferson City Fire Department, what are the pertinent fire department staffing statistics for similar sized communities?" In the 2002 study, *A Needs Assessment for the US Fire Service*, identified that communities serving populations of 5,000 to 9,999 were staffed on an average of 3.6 firefighters on-duty and able to respond (USFA, 2002, p.16). USFA further states:

> These results suggest that most of the all-volunteer, or mostly-volunteer fire departments, are averaging fewer than four firefighters responding to a mid-day house fire, and therefore are often failing to achieve the minimum standard response to initiate an interior attack …(USFA, 2002, p.18).

Durgin (2002), in an applied research project (APR) as part of the National Fire Academy's Executive Fire Officer's Program, wrote, "The author found that the minimum on-duty strength … should be six firefighter-emergency medical technicians…"(p. 35).

One of the few firefighter-staffing studies, which have had national significance, was the Dallas Fire Department Staffing Study of 1984. Although completed nearly twenty years ago, the study analyzed the difference between staffing fire apparatus with three, four or five firefighters. In a series of articles wrote for *Fire Command*, John O'Hagen detailed the differences in these staffing levels. O'Hagen (1985) stated that with three firefighters "the advance of the initial attack line is delayed until the hydrant connection is made" and "there is a loss of the hose line to protect the exposure" (p.21). Other items addressed with the crew size of three firefighters is the inability to provide for vertical (roof) ventilation and the unavailability of a second interior support (back-up line) (O'Hagen, 1985, p.21).

In summary of question two, the research showed that similar sized fire departments have larger average staffing the maximum of two firefighters that Jefferson City Fire Department currently staffs with.

In 2004, the Jefferson City Fire Department responded with an average of 9 firefighters on structure fires (JCFD, 2005, p. 10). This number was determined by calculating the number of career firefighters on duty and the number of paid-on-call firefighters responding directly to the scene.

PROCEDURES

The purpose of this research project was to identify the proper level of staffing for the Jefferson City Fire Department in comparison with national standards and state (Tennessee) trends. The project further wishes to promote firefighter safety and to prevent injury and death of firefighters on the scene of an emergency incident. The project involved extensive search if fire service trade journals and textbooks, magazines, technical reports, past Executive Fire Officer's Program (EFOP) Applied research Projects (APR) and a survey instrument presented to fire service executives.

Question Specific Procedures

Research Question 1. A thorough review of applicable national standards was made by searching internet resources, fire department library magazines and books and National Fire Code standards. A literature search was done at the National Fire Academy's Learning Resource Center during August and November 2004. Internet resources were used throughout the entire project. Furthermore, an extensive search was done with the Jefferson City Fire Department's copy of the NFPA National Fire Codes Subscription Service updated in the Fall of 2004.

Research Question 2. A survey instrument was developed and used in interviewing twenty-two fire departments throughout the state of Tennessee. The survey respondents were determined to have similar demographic characteristics as the Jefferson City Fire Department in population served, services rendered, municipal tax base, total calls and annual budget. A copy of the survey is in Appendix A, and a list of the departments surveyed and department contacts are listed in Appendix B. Telephone interviews were held to determine the answers to the surveys.

Research Question 3. Staffing records for the Jefferson City Fire Department were researched and the average daily staffing was determined. An interview with Florence Denton, Payroll clerk of for the City of Jefferson City was conducted to assist with the determination of the average daily staffing for the JCFD. With the help of Ms. Denton, departmental time sheets were used to determine the average daily staffing levels within the department.

Research Question 4. A comparison was made between what the staffing levels of the Department and results determined through the research of the national standards and guidelines and survey instrument.

Assumptions and Limitations

An assumption was made that other fire departments that had similar demographic characteristics, as the JCFD would be similarly staffed, have similar funding and provide similar staffing. Another assumption was made in that the senior staff interviewed at the individual departments would know the essential information about the communities they protected such as tax rate, population and total calls for the past year of 2004.

The survey instruments used in the interview process were directed to the senior member of the department in question. No one below the rank of Deputy or Assistant Chief was used to complete the interview information. Some Chief officers seemed to be uncertain about the information requested and had to research their own department's records. It is fair to say that the information was presented to the best of the respondent's ability. Another interesting limitation was determined when some of the respondents were hesitant to provide the requested information until the purpose of the inquiry was further explained. Stating the concern of "homeland security" has become an unfortunate consequence of living in a post 9-11 world. The final limitation was found to be the lack of recent studies of fireground effectiveness and its relationship to staffing. Many of the studies available were found to be conducted in the early nineteen eighties.

A final limitation was the lack of recent research in the area of fire department staffing. It seems that in a world of increased responsibilities for fire departments (from community risk reduction to homeland security duties) the abundance of staffing studies should be apparent. This was not discovered. It seems that fire departments are being asked to do more and more with current staffing levels which often appear inadequate even for fire response.

Definition of Terms

Immediately Dangerous to Life and Health (IDLH): An area or environment, which contains gases or other substances, that are not conducive to supporting human life.

International Association of Firefighters (IAFF): The predominant labor union of the majority of America's firefighters. The IAFF provides studies and research on topics such as firefighter staffing and safety.

Initial Rapid Intervention Crew (IRIC): a crew of at least two firefighters who are responsible for rescuing or assisting firefighters working on the scene of an emergency who become trapped, disoriented or injured and need assistance to safely evacuate the danger area.

Insurance Service Office (ISO) is a private company responsible for grading fire departments and establishing fire insurance costs for insurance companies providing coverage to residential and commercial occupancies.

National Fire Protection Association (NFPA): a private organization which develops consensus standards for adoption by agencies, states and municipalities dealing with fire/explosion prevention and life safety issues.

2 in, 2 out refers to the fire department practice and the requirement specified in the OSHA 1910.134 "Respiratory Protection Standard" that firefighters operating in an IDLH atmosphere must work in a minimal party of two firefighters and have two firefighters on the scene, staged at the exterior of the atmosphere to provide rescue or assistance services in the event that the interior firefighters become trapped, lost or become in need of other assistance.

Gallons per minute (GPM) is the total amount of water flowed through fire hose or water pipelines in one minute.

Occupational Safety and Health Administration (OSHA) is the federal or state administration responsible for safety in the workplace.

On Duty refers to firefighters who are housed in a fire station ready to immediately mount the appropriate fire apparatus and respond with the first due pieces of fire department apparatus.

RESULTS

The results of this applied research project were determined through review of national consensus standards, magazine articles and a survey instrument. Research questions are listed with the results of the findings and listed in a clear and concise narrative form.

What are the national standards applicable to guide fire departments staffing levels similar to the Jefferson City Fire Department? The search of applicable standards revealed that there are no less than five national consensus standards and one federal regulation. Examples found include: NFPA 1410, *Standard on Training for Initial Emergency Scene Operations (2000 Edition)*; NFPA 1500, *Standard on Fire Department Occupational Health and Safety Program* (2002 Edition); NFPA 1561, *Standard on Emergency Service Incident Management System* (2002 Edition); NFPA 1710, *Standard on the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the public by career Fire Departments* (2003 Edition) and NFPA1720, *Standard on the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the public by Volunteer Fire Departments*, (2003 Edition). OSHA 1910.134, Respiratory Protection Standard (1997) is the federal regulation detailing the requirements for

employers (fire departments) to allow personnel to enter and work in IDLH environments. Fire Departments must meet this regulation in structure fire attacks.

Compared to the Jefferson City Fire Department, what are the pertinent fire department statistics for similar sized communities? When reviewing the statistics of similar sized communities, it became evident that the Jefferson City Fire Department is below average as compared with other similar fire departments in the State of Tennessee. In the area of career firefighters in the department, the average number of career firefighters was seventeen as compared to the JCFD's seven career firefighters. Out of the seventeen fire departments that utilize volunteer or paid-on-call firefighters, the average number of use of this type of firefighter was sixteen. Out of the sample departments the average daily staffing was five career firefighters on duty and ready to respond with the first alarm assignment. The JCFD currently has twenty-two paid-on-call firefighters to supplement career firefighters. The majority of the departments surveyed operate out of two or more stations with the average number stations being two. JCFD currently operates out of one station.

Areas of the survey instrument also questioned the financial aspects of the fire department and government entity they represent. The average municipal tax rate of the departments surveyed was $1.38/$100 of assessed value of property. The City of Jefferson City's property tax rate is $.80/$100 value. The average fire department budget was $853,037.00. JCFD's 2004-2005 FY budget was $453,000.00.

The final area examined was the type of calls run by the departments and the services provided by the individual departments. The average number of calls in the year 2004 run by the departments was 697. The Jefferson City Fire Department ran 1013 calls

in 2004. Approximately 27 percent of the survey respondents only answer fire related calls (fire alarm activations, structure fires, and fire stand-bys at motor vehicle collisions). Sixty-eight percent of the surveyed fire departments respond to fire related calls, emergency medical services (EMS) first response calls and provide rescue services to its citizens.

What are the current staffing levels for the Jefferson City Fire Department? In this area, the research found that the Jefferson City Fire Department works a non-traditional fire department shift schedule. Firefighters work eight hour shifts and shift changes occur at eight o'clock in the morning, four o'clock in the evening and finally at twelve o'clock midnight. Upon reviewing weekly time sheets for the year 2004, it was determined that department staffing levels depend upon the day of the week and the shift being reviewed. From Tuesday to Friday, during the day shift (0800 – 1600 hours) the daily staffing level of on-duty firefighters was 1.89. Staffing during all other shifts was one career firefighter on duty. This is the minimum required level of staffing for the department. On some occasions, firefighters had to work sixteen hour or double shifts just to provide this minimal coverage. The average number of daily staffing for the survey respondents was seven per shift. None of the twenty-two fire departments surveyed utilized the eight-hour scheduling method. All twenty-two used some variant of a twenty-four hour scheduling program. Paulsgrove (2003) also observes, "In the entire United States, there are only a few fire departments using an 8-hour work schedule"(p.7-23).

How does the Jefferson City Fire Department current staffing levels for operations compare with national standards and other similar sized community fire

department? One of the most revealing findings of the research was that the Jefferson City Fire Department operates with 44% less career firefighters than the average community. In reviewing the identified national standards, the JCFD does not match that of the surveyed communities. Whereas the average daily staffing of the surveyed communities was seven firefighters on-duty at all times, the JCFD has a minimum of one firefighter and a maximum of two firefighters scheduled at all times. Further, the JCFD must rely on the arrival of paid-on-call firefighters in order to comply with the "two in, two out" requirement of OSHA standard 1910.135, *Respiratory Protection Standard*.

DISCUSSION

When compared to the identified national standards and the fire departments in the survey, the current level of staffing for the Jefferson City Fire Department is inadequate. Paulsgrove (2003) writes, "…it has been demonstrated that when staffing falls below four firefighters per company, fireground effectiveness may be compromised" (p. 7-22). The current staffing of the Department is woefully inadequate based upon the research materials found. Current fireground effectiveness is questionable at best within the scope of this research. Many of the standards listed detail the importance of having adequate fire response personnel available on first due apparatus. As stated by NFPA (2002), "In the initial stages of an incident where only one crew is operating in the hazardous area at a working structure fire, a minimum of four individuals shall be required …" (Section 8.4.7). If firefighters cannot assemble in safe, efficient numbers at the scene of a structure fire, the fire is only going to continue to grow larger and consume more of the structure, endangering firefighters and civilians in the area. Even in the training standard, NFPA 1410, *Standard on Training for Initial Scene Operations*, the

importance of having an adequate number of firefighters initially is emphasized by the tasks to be accomplished and levels of staffing for *each* responding apparatus. NFPA (2000) states:

> The minimum recommended staffing level for a fire company responding to any type of fire consists of four members responding on or arriving with each engine and aerial ladder company. Companies responding in high-risk areas should have a minimum acceptable staffing of six firefighters on ladder companies and five firefighters on engine companies (Section A-3-2.5).

With a minimum of first due apparatus consisting of two engine and an aerial ladder truck, this places the smallest level of staffing at twelve firefighters and this does not cover response to high risk areas. Jefferson City has numerous high-risk occupancies including a hospital, two pre-high school education facilities, seven college dormitories, two nursing homes and two assisted living facilities. Other high-risk occupancies include an industrial park with eight manufacturing facilities with no less than 100,000 square foot areas, numerous strip malls with multiple units and a 500,000 square foot warehouse in operation 24 hours a day.

Goldfeder (2004) states, “Fire departments can have wonderful equipment and beautiful fire stations but without trained people we can predict failure on the fireground”. Chief Goldfeder also suggests that fire departments look at the occupancies in their area and determine the needed staffing to extinguish fires and provide for the other tasks on the scene. He also suggests the following staffing to accomplish the assigned task at a small, residential, single story structure:

1. Establish water supply – 2 firefighters (1 for the hydrant and 1 as pump operator).
2. Stretch first hose line – 3 firefighters (1 operating the nozzle, 1 officer, and 1 doorman to assist with maneuvering the hose line in the structure).
3. Force Entry and search and rescue – 2 firefighters
4. Stretch second "back-up" hose line – 3 firefighters (1 operating the nozzle, 1 officer, and 1 doorman to assist with maneuvering the hose line)
5. Outside/Roof Ventilation – 2 firefighters
6. Laddering/Aerial Operation – 1 firefighter
7. Rapid Intervention Crew – 3 Firefighters – Dispatched initially and then backed up with others upon confirmation of a active structure fire.
8. Incident Command – 1 firefighter/officer

For a total of 18 firefighters (Goldfeder, 2004)

Goldfeder (2004) also states that staffing, or lack thereof, is one of the common factors that result in firefighter injuries and deaths.

John Cook, in the book, *Standard Operating Procedures and Guidelines,* also details the importance of staffing the first alarm assignment with enough firefighters. Cook (1998) states, "It shall be the policy of the department to dispatch a minimum of 16 personnel to a reported structure fire on the initial alarm" (p. 176). In the event that 16 firefighters are not available on the first alarm, he states, "…the Incident Commander should alter the tactical operations to ensure adequate firefighter safety" (Cook, 1998, p. 176). Lastly, Cook (1998) states:

> Assembling 16 personnel on scene at a fire control incident will allow for an aggressive interior attack with a maximum fire flow of 500 GPM, and it will also enable the proper support functions to be performed (p. 177).

NFPA also discusses fire department staffing in NFPA 1500. As stated earlier, fire departments must provide adequate response on the onset of a working fire. In order to safely control the fire, stop the spread of the fire and safely remove the victims, fire departments must provide firefighters to complete the required tasks. As NFPA (2002) states:

> In the initial stages of an incident where only one crew is operating in the hazardous area at a working structure fire, a minimum of four individuals shall be required, consisting of two individuals working as a crew in the hazard area and two individuals present outside this hazard area available for assistance or rescue at emergency operations where entry into the danger area is required (Section 8.4.7).

National Fire Protection Association 1710 also requires a minimum of four firefighters to respond to calls for service, including structure fires, wildland fires and emergency medical incidents. This level of response may be more if the units are responding to high-risk occupancies.

Also in respect to staffing and emergency response, NPFA 1720 requires that volunteer fire departments assembly a minimum of four firefighters on scene prior to beginning interior fire suppression operations.

Rukavina (2001) states, “Many fire chiefs will find themselves responsible for managing this historic shift, mediating between the proverbial irresistible for of the

National fire Protection Association , NFPA 1710, and the immovable object of local willingness (or ability) to pay" (p.3).

Finally, OSHA regulation 1910.134 specifically defines structural fire fighting operations beyond the incipient phase must have a minimum of four firefighters on the scene for interior operations to begin. The "two in, two out" regulation clearly states that at least two firefighters must remain outside the IDLH atmosphere to be able to assist the two person entry team, should problems develop with the firefighters operating on the inside of the structure (OSHA, 1998, paragraph 134).

The author concludes that the minimum level of staffing for the Jefferson City Fire Department should be at least four firefighters on each shift. Not only do the referenced standard and regulations state that a minimum of four firefighters are required before almost any operation can be even started on the fire scene, but the discovery of the average daily staffing in the comparative fire departments of five firefighters available for the first alarm, made it painfully clear that the Department is doing the job with 80% less of the staff of the examined departments. The Department is not meeting the required number of on scene personnel at even 13, with the average response of nine as determined by the 2004 Annual Fire Department Operations Report.

In the past, the author and fire department has been accused of attempting to increase fire department staffing and questioned on his motivations as to requesting and submitting budgets and proposals which request additional staffing. This research project and the survey results show the condition of current department staffing based upon local, similarly sized communities and national standards.

It is a given, that in the current environment fire departments exist in, that the future is questionable at best. As seen in the last few years, the role of the department will change in the future and fit the mold of domestic first responders in homeland security, all hazard risk reducers in the local community and the general "go to" guys is all things emergency. However, we can not even provide the basic services which we are requested to perform presently, without adequate numbers of firefighters to staff, respond and function safely at the incident.

RECOMMENDATIONS

The research clearly shows the need to add firefighters to the on-duty staff at the Jefferson City Fire Department. It is feasible to determine that on-duty staffing should be raised to a minimum of four firefighters per shift. Further, the current shift schedule should be changed to better reflect a traditional, 24-hour schedule. By changing to a 24-hour scheduling system, the department would only need to hire an additional five career firefighters. With a cost of approximately $165,220 in the first year, the City should seek additional funding means including the raising of property taxes, development and use of a permitting and inspection fee program through the fire department or allocations from the City's fund reserve. The benefits of additional staffing are numerous; more firefighters arriving together are able to function more safely and effectively to mitigate the call in a quicker, more professional manner.

The City of Jefferson City should begin to tie city departments to a master planning program and the fire department should develop a master plan which addresses the areas of future funding of staffing increases, focusing on and delivering better

services to the internal (employee) and external (civilian) customers, increased funding/participation of reserve firefighters and equipment/apparatus replacement.

The reserve firefighter program should be reviewed and policies should be implemented to increase department response on first alarms to structure fires and other alarms. Reserve firefighters should meet the same requirements as career firefighters in the areas of training, certification and ability to work at he incident scene. A reserve firefighter stand-by policy should be developed, implemented and enforced to assist the department in assuring that adequate numbers of firefighters are arriving on the scene of the fire within the first minutes (preferably on first due apparatus).

The Department's Fire Explorer Program needs to be evaluated and re-started. A recruiting drive at the local high school should be conducted and the program needs to set goals in the area of training, education and competition. By supporting this program, the Department is setting the building blocks of the future for the Department.

Finally, the Department needs to examine the options of recruiting local college students for the fire service. The option of free boarding to college students needs to be researched. The benefits of a "Sleeper Program" need to be fully thought out and discussed with interested parties.

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Appendix A

JEFFERSON CITY FIRE DEPARTMENT

112 W. Broadway Blvd. Jefferson City, TN 37760 Telephone (865) 475-3616

FIRE DEPARTMENT COMPARISION SURVEY

Fire Department Name: _____

Completed By: _____

Chief's Name: _____

1. Population Protected (City):	
2.Total Number of Career Firefighters:	
3. Total Number of Volunteer or Paid-on-Call Firefighters:	
4. On-Duty Firefighter Staffing Level:	
5. Municipal Property Tax Rate:	
6. FY 2004-2005 Fire Department Budget:	
7. Total Calls for Calendar Year 2004:	
8. Services Provided (such as EMS, Rescue, Fire Suppres.)	
9. Number of Fire Stations:	
10. Department/Jurisdiction's ISO Rating	

Thank you for your assistance in this survey, if you like a copy of the survey results, please indicate (Y)es or (N)o.

Appendix B
Fire Departments Participating in Survey

Fire Department	*Fire Chief*
Alcoa, TN Fire Department	Chief Larry Graves
Arlington, TN Fire Department	Chief Dennis Rutledge
Ashland City, TN Fire Department	Chief Chuck Walker
Bolivar, TN Fire Department	Chief Jake Baker
Covington, TN Fire Department	Chief Jerry Craig
Clinton, TN Fire Department	Chief Archie Brummett
Crossville, TN Fire Department	Chief Mike Turner
Fayetteville, TN Fire Department	Chief Robert Strope
Harriman, TN Fire Department	Chief Lane Best
Lafayette, TN Fire Department	Deputy Chief Keith Scruggs
Lenoir City, TN Fire Department	Chief Richard Martin
Lexington, TN Fire Department	Chief Danny Barker
Loudon, TN Fire Department	Chief Chris Brumbecker
Manchester, TN Fire Department	Chief Sam Miller
Martin, TN Fire Department	Chief Oran True
Milan, TN Fire Department	Chief James Fountain
Newport, TN Fire Department	Chief Wayne Butler
Paris, TN Fire Department	Chief Charlie Smith
Rockwood, TN Fire Department	Chief Ed Wortz
Savannah, TN Fire Department	Chief Jerry Shelly
Sparta, TN Fire Department	Chief Ed Kay